

WHAT IS CLAIMED IS:

1. A prosthetic heart valve, comprising:
 - a flexible stent having alternating inflow cusps and outflow commissures;
 - a plurality of flexible leaflets attached to the stent so as to form a one-way
 - 5 valve within the stent; and
 - a suture-permeable connecting band attached to the stent providing an interface between the valve and surrounding host tissue;
 - wherein the connecting band conforms to the alternating stent cusps and commissures and defines an axial gap along the commissures opening in the
 - 10 inflow direction for enhancing freedom of movement of the stent cusps.
2. The prosthetic heart valve of claim 1, wherein there are three stent cusps and three commissures.
- 15 3. The prosthetic heart valve of claim 1, wherein the connecting band includes three cusp portions separated by three upstanding commissure portions, and wherein the cusp portions each define an inner generally radially oriented ledge for receiving and supporting the stent cusps.
- 20 4. The prosthetic heart valve of claim 3, wherein the connecting band further includes outer free margins that are angled upwardly and outwardly with respect to a central axis of the connecting band at each cusp portion and gradually re-align to be parallel to the central axis along the commissure portions..
- 25 5. The connecting band of claim 1, wherein the stent has bioresorbable commissures and is designed to separate the valve into individual leaflets after implant, and the connecting band is discontinuous at the stent commissures.
- 30 6. The prosthetic heart valve of claim 1, wherein the stent comprises a fabric covered rod-like structure.

7. The prosthetic heart valve of claim 6, wherein the fabric covering closely surrounds the rod-like structure and exhibits a flap projecting outward therefrom substantially the entire length of the stent cusps and commissures.

5 8. The prosthetic heart valve of claim 7, wherein the flap has a width that varies along the cusps and commissures of the stent, the flap being narrower in the cusps.

9. The prosthetic heart valve of claim 7, wherein the leaflets each have an arcuate cusp edge and a coapting edge, and wherein the connecting band attaches along
10 the fabric covering flap and the cusp edges of the leaflets are attached between the band and the stent flap.

10. The prosthetic heart valve of claim 7, wherein the connecting band attaches along the fabric covering flap and has a free margin extending outward from the
15 stent along the alternating cusps and commissures for connecting the heart valve to an anatomical orifice.

11. The prosthetic heart valve of claim 1, wherein the stent is highly flexible and permits relative radial cusp movement.

20 12. The prosthetic heart valve of claim 11, wherein the stent is made of Nitinol.

13. A highly flexible prosthetic heart valve, comprising:

25 a flexible elongated stent formed generally in a tube with cusp regions on an inflow end alternating with commissure tips on an outflow end to form an undulating periphery, the stent having commissure regions on either side of each cusp region wherein the commissure tips join adjacent commissure regions and the juxtaposed commissure regions define axial spaces therebetween; and

30 a suture-permeable band attached along the undulating periphery of the stent and providing an interface between the valve and surrounding host tissue.

14. The prosthetic heart valve of claim 13, wherein the band includes arcuate cusp portions generally conforming to the stent cusp regions and commissure portions therebetween each having an inverted U-shape to define a downwardly opening gap that enhances flexibility of the valve.

15. The prosthetic heart valve of claim 14, wherein the commissure portions of the band are generally planar and axially aligned, and the cusp portions of the band each include an outwardly angled portion and an inwardly angled ledge sized to support the stent cusp regions.

16. The prosthetic heart valve of claim 15, wherein the inwardly angled ledges of the cusp portions of the band are sized to support the stent cusp regions.

17. The prosthetic heart valve of claim 15, wherein the suture-permeable band has a free margin along the undulating periphery for connecting the heart valve to an anatomical orifice.

18. The prosthetic heart valve of claim 13, wherein the axial spaces are generally triangular and gradually increase in size from the attached commissure tips to the diverging cusp regions.

19. The prosthetic heart valve of claim 13, wherein the stent is highly flexible and permits relative radial cusp movement.

20. The prosthetic heart valve of claim 19, wherein the stent is made of Nitinol.

21. The prosthetic heart valve of claim 13, wherein the stent has bioresorbable commissures and is designed to separate the valve into individual leaflets after implant, and the suture-permeable band is discontinuous at the stent commissures.

22. The prosthetic heart valve of claim 13, further comprising a fabric covering on the stent that exhibits a flap projecting outward therefrom substantially the entire length of the undulating periphery.

5

23. The prosthetic heart valve of claim 22, further comprising a plurality of flexible leaflets attached to the stent so as to form a one-way valve within the stent wherein the leaflets each have an arcuate cusp edge and a coapting edge, and wherein the suture-permeable band attaches along the fabric covering flap and the cusp edges of the leaflets are attached between the band and the stent flap.

10

24. A connecting band for a heart valve, comprising:
a suture-permeable connecting band generally formed in a tubular configuration and including an undulating periphery defined by three cusp portions separated by three upstanding commissure portions, wherein the commissure portions of the connecting band define generally axial gaps that help permit flexing of the valve.

15

25. The connecting band of claim 24, wherein the band comprises an inner member surrounded by a fabric cover.

20

26. The connecting band of claim 25, wherein the inner member is molded of silicone rubber and the fabric cover is polyterephthalate.

27. The connecting band of claim 24, wherein the three cusp portions each define an inner generally radially oriented ledge and an upwardly angled outer free margin.

25

28. The connecting band of claim 27, wherein each ledge has its greatest radial dimension at the midpoint of the respective cusp portion and gradually tapers down in size toward the adjacent commissure portions.

30

29. The connecting band of claim 27, wherein the free margins form their greatest outward angle with respect to a central axis of the connecting band at each cusp portion, and gradually re-align to be parallel to the central axis along the commissure portions.

30. The connecting band of claim 24, wherein the connecting band is discontinuous at the commissure portions.

10